INDUSTRIAL MAINTENANCE TECHNOLOGY

Program of Studies

2014-2015

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Office of Career and Technical Education
Kentucky Department of Education

INDUSTRIAL MAINTENANCE TECHNOLOGY

Program Area Course Title	Post-Secondary Connection	Valid Course Code	Recommended Grade Level							Recommended Credit
Industrial Maintenance Technology Course List										
			6	**7**	**8**	**9**	**10**	**11**	**12**	
Advanced Hydraulic Systems	**MST 200**	**470316**						**X**	**X**	**.5**
Advanced Hydraulic Systems (lab)	**MST 201**	**470346**						**X**	**X**	**.5**
Advanced Pneumatic Systems	**MST 204**	**470326**						**X**	**X**	**.5**
Advanced Pneumatic Systems Lab	**MST 205**	**470327**						**X**	**X**	**.5**
Applied Machining 1 (Ind. Maint.)	**CMM120**	**470360**							**X**	**1**
Basic Blueprint Reading	**BRX 120**	**470302**				**X**	**X**	**X**	**X**	**.5**
Basic Troubleshooting	**BTX 205**	**470317**						**X**	**X**	**.5**
Blueprint Reading for Machinists	**BRX 112**	**470921**				**X**	**X**	**X**	**X**	**1**
Cooling & Dehumidification (Ind. Maint.)	**ACR 250**	**470361**						**X**	**X**	**.5**
Cooling & Dehumidification Lab (for Maintenance)	**ARC 251**	**470362**						**X**	**X**	**.5**
CO-OP I (Ind. Maint.)	**IMT 199**	**470305**						**X**	**X**	**1**
CO-OP II (Ind. Maint.)	**IMT 299**	**470306**							**X**	**2**
CO-OP III (Ind. Maint.)	**IMT 199+IMT 299**	**470307**							**X**	**3**
Electrical Components	**ACR 130**	**470358**								**.5**
Electrical Components (lab)	**ACR 131**	**470359**								**.5**
Fluid Power	**FPX 100**	**470321**					**X**	**X**	**X**	**.5**
Fluid Power Lab	**FPX 101**	**470325**					**X**	**X**	**X**	**.5**
Fundamentals of Machine Tool – A (Ind.Maint)	**CMM 110**	**470313**					**X**	**X**	**X**	**1**
Fundamentals of Machine Tool – B (Ind.Maint)	**CMM 112**	**470314**					**X**	**X**	**X**	**1**
Heating & Humidification (Ind. Maint.)	**ACR 260**	**470363**						**X**	**X**	**.5**
Heating & Humidification (lab) (Ind. Maint.)	**ACR 261**	**470364**						**X**	**X**	**.5**
Gas Metal Arc Welding	**WLD 140 (ind. Maint)**	**470367**				**X**	**X**	**X**	**X**	**.5**
Gas Metal Arc Welding Lab	**WLD 141(ind. Maint)**	**470368**				**X**	**X**	**X**	**X**	**.5**

HVAC Electricity (Ind. Maint.)	**ACR 102**	**470365**					**X**	**X**	**X**	**.5**
HVAC Electricity Lab (Ind. Maint.)	**ARC 103**	**470366**					**X**	**X**	**X**	**.5**
Industrial Maintenance Electrical Motor Controls	**IMT 220**	**470348**						**X**	**X**	**.5**
Industrial Maintenance Electrical Motor Controls (lab)	**IMT 221**	**470347**						**X**	**X**	**.5**
Industrial Maintenance of PLC's	**IMT 230**	**470330**						**X**	**X**	**.5**
Industrial Maintenance of PLC's (lab)	**IMT 231**	**470331**						**X**	**X**	**.5**
Industrial Maintenance Electrical Principles	**IMT 110**	**470322**				**X**	**X**	**X**	**X**	**.5**
Industrial Maintenance Electrical Principles (lab)	**IMT 111**	**470323**				**X**	**X**	**X**	**X**	**.5**
Internship I (Ind.Maint)	**IMT 198**	**470308**						**X**	**X**	**1-3**
Maintaining Industrial Equipment	**IMT 150**	**470318**					**X**	**X**	**X**	**.5**
Maintaining Industrial Equipment (lab)	**IMT 151**	**470319**				**X**	**X**	**X**	**X**	**.5**
Motor Control Concepts (IMT)	**IMT 240**	**470333**						**X**	**X**	**.5**
Motor Control Concepts (IMT) (lab)	**IMT 241**	**470334**						**X**	**X**	**.5**
Refrigeration Fundamentals (Ind. Maint.))	**ACR 100**	**470349**				**X**	**X**	**X**	**X**	**.5**
Refrigeration Fundamentals (lab) (Ind. Maint.)	**ACR 101**	**470350**				**X**	**X**	**X**	**X**	**.5**
Robotics and Industrial Automation (Ind. Maint.)	**ENGT 260**	**470351**						**X**	**X**	**.5**
Robotics and Industrial Automation Lab-A ((Ind. Maint.)	**ENGT 261**	**470352**						**X**	**X**	**.5**
Robotics and Industrial Automation Lab-B (Ind. Maint.)	**ENGT 263**	**470353**						**X**	**X**	**.5**
Shielded Metal Arc Welding (SMAW) (Ind. Maint.)	**WLD 121**	**470354**				**X**	**X**	**X**	**X**	**.5**
Shop Management	**SMX 100**	**470301**				**X**	**X**	**X**	**X**	**.5**
SMAW Fillet Lab (Ind. Maint.)	**WLD 120**	**470355**				**X**	**X**	**X**	**X**	**.5**
Welding for Maintenance	**IMT 100**	**470328**				**X**	**X**	**X**	**X**	**.5**
Welding for Maintenance (Lab)	**IMT 101**	**470329**				**X**	**X**	**X**	**X**	**.5**

INDUSTRIAL MAINTENANCE TECHNOLOGY

Overview of Industrial Maintenance

Purpose:

The vision of Industrial Maintenance is to promote safety standards, performance standards, enhance leadership, provide relevant curriculum, and to be vital to the education of all students.

Industrial Maintenance is the lifeline of today's industry. Industrial Maintenance programs will provide a structured yet flexible training program for those interested in developing the technical skills required to keep industry operating. Maintenance technicians will be trained to be proficient in many different areas including plant safety, electromechanical equipment, industrial rigging, reading technical schematics, bearings, lubrication, centrifugal pumps, alignment, piping systems, mechanical drives, hydraulics/pneumatics, industrial electricity, motor controls, vibration analysis, troubleshooting, machining and welding. The field of Industrial Maintenance employs techniques from physics, engineering, and decision analysis for the repair and maintenance of all equipment used in industrial facilities.

Industrial Maintenance Technology will:

- Operate as the pathway for manufacturing skill technology in schools.
- Operate as the venue for nationally recognized industry standard training.
- Provide a critical link in school to employment or postsecondary education.
- Develop stronger relationships with the business and industry community in terms of mutual advocacy, cooperative education experiences, employment placement, and support for SkillsUSA experiences.
- Represent a necessary component in the education of all students.
- Require and promote critical thinking and problem solving.
- Offer Nationally Recognized Industry Certifications.
- Offer a flexible curriculum based on standards that adapts to change and meet the needs of industry.
- Integrate common core standards into the Industrial Maintenance Technology curriculum in order to insure that students develop excellent written & verbal communications skills, occupational skills, and scientific problem-solving skills.

Career Pathway:

- ❖ Industrial Maintenance Mechanic Level 1
- ❖ Industrial Maintenance Electrical Trainee
- ❖ Industrial Maintenance Machinist Helper 1
- ❖ Fluid Power Pneumatic Mechanic
- ❖ Refrigeration Technician

Industrial Standards Curriculum

The Industrial Maintenance Technology curriculum is composed of standards based competencies. All Industrial Maintenance Technology programs incorporate industry and common core standards thus increasing the student's qualifications toward successful employment.

Alignment of the Industrial Maintenance Technology curriculum with nationally recognized industry standards and the common core standards provides optimal preparation for students to acquire an industry certification.

Communities understand that this preparation provides better career opportunities for students and the demands of today's workforce for the 21st century.

Nationally Recognized Industry Certifications offered through the Industrial Maintenance Program

Each industry certifications requires students to pass both a written and performance exam. This qualifies that the student has acquired the knowledge and skills required to be employable to industry.

- NCCER Industrial Maintenance Mechanic Level 1
- NCCER Industrial Maintenance Electrical and Instrumentation Tech level 1
- NCCER Electrical Certification Level 1
- NCCER HVAC Level 1
- EPA Section 608 Technician
- NIMS (Machine Tool)

The Kentucky Occupational Skill Standards Assessment

A written exam of industry standards that identify the knowledge, skills, and abilities an individual needs to succeed in the workplace. These standards describe the necessary **occupational, academic,** and **employability** skills needed to enter the workforce or post- secondary education in specific career areas.

Interdisciplinary Courses

The Kentucky graduation requirements allow for interdisciplinary or applied courses to substitute for specific academic courses required for graduation. In the manufacturing curriculum IMT courses may count as the 4th math credit to meet graduation requirements.

Work Based Learning

Cooperative experience, internships, shadowing and mentoring opportunities and pre-apprenticeships provide depth and breadth of learning in the instructional program and allow students to apply the concepts learned in the classroom. The Work Base Learning Guide is available on the KDE webpage: www.education.ky.gov.

Student Organization

Participation in SkillsUSA, provides a vehicle for students to employ higher order thinking skills, to interact with high-level business people and to further enhance their leadership skill through their participation in regional, state and national competitive events and local activities.

KDE/OCTE Career Pathways Industrial Maintenance Technology 2014-2015		
Career Pathway	**Core Courses**	**Elective Courses**
Industrial Maintenance Mechanic **CIP Code: 47.0303.01** **Tests for Certification** • **National Center for Construction and Education Research-(NCCER) Industrial Maintenance Mechanic (Level 1)** • **Kentucky TRACK Pre-Apprenticeship Certification** • **KOSSA**	• **FPX 100 Fluid Power- 470321** • **FPX 101 Fluid Power/ (lab)-470325** • **IMT 110 Industrial Maint. Electrical Principles-470322** • **IMT 111 Industrial Maint. Electrical Principles / (lab)-470323** • **IMT 150 Maintaining Industrial Equipment-480318** • **IMT 151 Maintaining Industrial Equipment (Lab)-480319** • **One Elective**	• **ACR-130-Electrical Components-470358** • **ACR-131-Electrical Components Lab-470359** • **BTX 205 Basic Troubleshooting-470317** • **BRX 120 Basic Blueprint Reading-470302** • **BRX 112 Blueprint Reading for Machinist-470921** • **IMT 100 Welding for Maintenance-470328** • **IMT 101 Welding for Maintenance (lab)-470329** • **WLD 140 Gas Metal Arc Welding (Ind.Maint.)-470367** • **WLD 141 Gas Metal Arc Welding Lab (Ind.Maint.)-470368** • **WLD 120-Shielded Metal Arc Welding (SMAW) (Ind. Maint.)-470354\480521** • **WLD 121Shielded Metal Arc Welding (SMAW) LAB (Ind. Maint.)-470355\480527** • **Machine tool A (for maintenance)-470313** • **Machine tool B (for maintenance)-470314** • **CMM 120- Applied Machining I – 4703??** • **IMT 198-Internship I (Ind.Maint)-470308** • **PLTW IED-Introduction to Engineering Design-219901** • **Shop Management-470301** • **IMT 199-CO-OP I (Ind. Maint.)-470305** • **IMT 299-CO-OP I**

		(Ind. Maint.)-470306 • **IMT 199+299-CO-OP I (Ind. Maint.)-470307**
Industrial Maintenance Electrical Technician **CIP Code: 47.0303.02** **Tests for Certification** • **NCCER Electrical (Level 1)** • **NCCER Industrial Maintenance Electrical and Instrumentation Technician (Level 1)** • **Kentucky TRACK Pre-Apprenticeship Certification** • **KOSSA**	• **IMT 110 Industrial Maint. Electrical Principles-470322** • **IMT 111 Industrial Maint. Electrical Principles / (lab)-470323** • **Industrial Maint. Electrical Motor Controls-470348** • **Industrial Maint. Electrical Motor Controls / (lab)-470347** • **Motor Control Concepts-470333** • **Motor Control Concepts/Lab-470334** • **One Elective**	• **Hydraulic Systems Advanced-470316** • **Hydraulic Systems advanced/Lab-470346** • **BTX 205 Basic Troubleshooting-470317** • **BRX 120 Basic Blueprint Reading-470302** • **BRX 112 Blueprint Reading for Machinist-470921** • **Industrial Maintenance of PLC-470330** • **Industrial Maintenance of PLC / Lab-470331** • **IMT 150 Maintaining Industrial Equipment-480318** • **IMT 151 Maintaining Industrial Equipment (Lab)-480319** • **ENGT 260-Robotics and Industrial Automation (Ind. Maint.)-470351** • **ENGT 261-Robotics and Industrial Automation Lab A (Ind. Maint.)-470352** • **ENGT 263-Robotics and Industrial Automation Lab B (Ind. Maint.)-470353** • **PLTW IED-Introduction to Engineering Design-219901** • **Shop Management-470301** • **IMT 199-CO-OP I (Ind. Maint.)-470305** • **IMT 299-CO-OP I (Ind. Maint.)-470306** • **IMT 199+299-CO-OP I (Ind. Maint.)-470307** • **IMT 100 Welding for Maintenance-470328** • **IMT 101 Welding for**

		Maintenance (lab)-470329 • **PLTW CIM-Computer Integrated Manufacturing-219904**
Fluid Power Pneumatic Mechanic **CIP Code: 47.0303.04** **Tests for Certification** • **NCCER – Industrial Maintenance Mechanic Level 1** • **Kentucky TRACK Pre-Apprenticeship Certification** • **KOSSA**	• **FPX 100 Fluid Power- 470321** • **FPX 101 Fluid Power/ (lab)-470325** • **Hydraulic Systems Advanced-470316** • **Hydraulic Systems advanced/Lab-470346** • **Pneumatic Systems-470326** • **Pneumatic Systems/Lab-470327** • **One Elective**	• **BTX 205 Basic Troubleshooting-470317** • **BRX 120 Basic Blueprint Reading-470302** • **BRX 112 Blueprint Reading for Machinist-470921** • **IMT 150 Maintaining Industrial Equipment-480318** • **IMT 151 Maintaining Industrial Equipment (Lab)-480319** • **IMT 199-CO-OP I (Ind. Maint.)-470305** • **IMT 299-CO-OP I (Ind. Maint.)-470306** • **IMT 199+299-CO-OP I (Ind. Maint.)-470307** • **ENGT 260-Robotics and Industrial Automation (Ind. Maint.)-470351** • **ENGT 261-Robotics and Industrial Automation Lab A (Ind. Maint.)-470352** • **ENGT 263-Robotics and Industrial Automation Lab B (Ind. Maint.)-470353** • **IMT 110 Industrial Maint. Electrical Principles-470322** • **IMT 111 Industrial Maint. Electrical Principles / (lab)-470323** • **PLTW IED-Introduction to Engineering Design-219901** • **Shop Management-470301**

Refrigeration Technician **CIP Code: 47.0303.05** **Tests for Certification** • **EPA Section 608 Certification** • **NCCER – HVAC Level 1** • **Kentucky TRACK Pre-Apprenticeship Certification** • **KOSSA**	• **Refrigiration Fundamentals (Ind. Maint.)-470349** • **Refrigiration Fundamentals / Lab (ind. Maint.)-470350** • **HVAC Electricity (Ind. Maint.)-470365** • **HVAC Electricity / Lab (Ind. Maint.)-470366** • **ACR-130-Electrical Components-470358** • **ACR-131-Electrical Components Lab-470359** • **One Elective**	• **BTX 205 Basic Troubleshooting-470317** • **BRX 120 Basic Blueprint Reading-470302** • **BRX 112 Blueprint Reading for Machinist-470921** • **Heating & Humidification (Ind. Maint.)-470363** • **Heating & Humidification Lab (Ind. Maint.)-470364** • **Cooling & Dehumidification (Ind. Maint.)-470361** • **Cooling & Dehumidification Lab (Ind. Maint.)-470362** • **IMT 199-CO-OP I (Ind. Maint.)-470305** • **IMT 299-CO-OP I (Ind. Maint.)-470306** • **IMT 199+299-CO-OP I (Ind. Maint.)-470307** • **PLTW IED-Introduction to Engineering Design-219901** • **Shop Management-470301**
Industrial Maintenance Machinist Technician **CIP Code: 47.0303.03** **Tests for Certification** • **National Institute for Metal working Skills (NIMS-Machine Tool)** • **Kentucky TRACK Pre-Apprenticeship Certification** • **KOSSA**	• **BRX 112 Blueprint Reading for Machinist-470921** • **Machine Tool A (for maintenance)-470313** • **Machine Tool B (for maintenance)-470314** • **CMM 120- Applied Machining I – 470360**	• **IMT 150 Maintaining Industrial Equipment-480318** • **IMT 151 Maintaining Industrial Equipment (Lab)-480319** • **BRX 120 Basic Blueprint Reading-470302** • **BRX 112 Blueprint Reading for Machinist-470921** • **IMT 100 Welding for Maintenance-470328** • **IMT 101 Welding for Maintenance (lab)-470329** • **WLD 140 Gas Metal Arc Welding (Ind.Maint.)-470367** • **WLD 141 Gas Metal Arc Welding Lab**

		(Ind.Maint.)-470368 • **WLD 120-Shielded Metal Arc Welding (SMAW) (Ind. Maint.)-470354** • **WLD 121Shielded Metal Arc Welding (SMAW) LAB (Ind. Maint.)-470355** • **IMT 199-CO-OP I (Ind. Maint.)-470305** • **IMT 299-CO-OP I (Ind. Maint.)-470306** • **IMT 199+299-CO-OP I (Ind. Maint.)-470307** • **PLTW IED-Introduction to Engineering Design-219901** • **Shop Management-470301**

Industrial Maintenance Electrical TRACK **CIP Code: 47.0303.99** **Tests for Certification** • **NCCER – Industrial Maintenance Mechanic Level 1** • **Kentucky TRACK Pre-Apprenticeship Certification** • **KOSSA**	• **(4)- Core courses** • **Chosen from IMT valid course list.** • **By Company sponsoring State Registered Apprenticeship.**	• **(4)- Core courses** • **Chosen from IMT valid course list.** • **By Company sponsoring State Registered Apprenticeship.**

KENTUCKY CAREER PATHWAY/PROGRAM OF STUDY TEMPLATE

COLLEGE/UNIVERSITY: KCTCS/Kentucky Universites
HIGH SCHOOL (S): Kentucky High; OCTE ATC/CTC
CLUSTER: Manufacturing
PATHWAY: Maintenance Manager/Supervisor
PROGRAM: Industrial Maintenance Technology

	GRADE	ENGLISH	MATH	SCIENCE	SOCIAL STUDIES	REQUIRED COURSES / RECOMMENDED ELECTIVE COURSES / OTHER ELECTIVE COURSES / CAREER AND TECHNICAL EDUCATION COURSES			CREDENTIAL CERTIFICATE DIPLOMA DEGREE	SAMPLE OCCUPATIONS
SECONDARY	9	English I	Algebra I	Earth Science	US History	Vis/Perf Arts	Computer Literacy			
	10	English II	Geometry	Biology	World Civilization	Health & PE	Fluid Power/Lab 470321/4	Ind. Maint. Electrical Principles/Lab		
	11	English III	Algebra II	Phyical Sc.	Economics	Maintaining Industrial Equip./Lab 470318/470319	Advanced Hydralic System	Ind. Maint. Electrical Motor Controls/(lab)	NCCER Maintenance Mechanic	
	12	English IV	4th Math	World Geogragphy	Foreign Language	Advanced Pneumatic Systems/Lab 470326/470327	Motor Control Concepts/L	IMT 199 Co-op/Capstone Course 470305	NCCER Industrial Maintenance Electrical	Apprenticeship/ Maintenance Technician
POSTSECONDARY	Year 13	Writing I	Tech Math/Alg or College Alg	Chemistry	Social Interaction	MTT 110 Machining Fundamentals	MST 204 Advanced Pneumatic Systems	Occupational Safety		
	Year 14	Oral Communication	Materials Scien	Calculus	Heritage / Humanities	Welding	IMT 240 Motor Control Concepts	18 hours Technical Elective	AAS / GOTS	Maintenance Group Leader
	Year 15	ENG 200 ENG 300	Eng. Physics	Cat D Elect	Cat B II Elect Cat B II Elect	AMS 271 Industrial Statistics AMS 310 Work Design / Ergonomics	AMS 355 Systems Design AMS 365 Systems Operation	Design Engineering		
	Year 16	Foreign Language	Fluid Mechanic	Humanities	Cat C Elect Cat C Elect Cat E Elect	AMS 371 Quality Assurance AMS 390 Project Planning and Control	AMS 430 Tech Management/Supervision/ Team Bldg AMS 490 Senior Reaseach	AMS 307 Technical Writing	BS	Maintenance Supervisor

CCTI College and Career Transitions Initiative

Funded by the U. S. Department of Education (V051B020001)

Revised Jan. 2005

October, 2006-CTE/Kentucky

Required Courses

Recommended Elective Courses

Other Elective Courses

Career and Technical Education Courses

Credit-Based Transition Programs (e.g. Dual/Concurrent Enrollment, Articulated Courses, 2+2+2)

(◆=High School to Comm. College) (● =Com. College to 4-Yr Institution) (■ = Opportunity to test out)

Mandatory Assessments, Advising, and Additional Preparation

Note: Categories of courses (e.g. Required, Recommended Electives, other Electives and career and Technical Education) apply to both secondary and postsecondary levels.

Advanced Hydraulic Systems
470316

Course Description: The advanced hydraulic systems class will cover design, repair, and troubleshooting of hydraulic systems.

Prerequisites: Fluid Power-470321
Fluid Power Lab-470325

Content/Process

Students will:

1. Describe the properties of hydraulic fluid.
2. Describe how an accumulator performs in a circuit.
3. Install and operate an accumulator into a circuit.
4. Install and operate a pilot-operated check valve.
5. Install and operate a pressure-compensated flow control valve.
6. Install and operate a pilot-operated directional control valve.
7. Install and operate a pressure port check valve.
8. Install and operate a cam-operated valve.
9. Hook up and operate unloading circuits.
10. Install and operate by remote a pilot-operated pressure control valve.
11. Describe transducers
12. Describe electrhydraulic servo valve characteristics.
13. Operate an electrohydraulic servo valve.
14. Install a hydraulic pump and align.
15. Repair a hydraulic cylinder.
16. Choose a hydraulic cylinder for a specific application.
17. Interpret hydraulic schematics.
18. Troubleshoot a hydraulic circuit.
19. Design a hydraulic circuit.
20. Repair valves.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Advanced Hydraulic Systems (Lab)
470346

Course Description: The advanced hydraulic systems class will cover design, repair, and troubleshooting of hydraulic systems.

Prerequisite: Fluid Power-470321
Fluid Power Lab-470325
Co-requisite: Advanced Hydraulic Systems-470316

Content/Process

Students will:

1. Describe the properties of hydraulic fluid.
2. Describe how an accumulator performs in a circuit.
3. Install and operate an accumulator into a circuit.
4. Install and operate a pilot-operated check valve.
5. Install and operate a pressure-compensated flow control valve.
6. Install and operate a pilot-operated directional control valve.
7. Install and operate a pressure port check valve.
8. Install and operate a cam-operated valve.
9. Hook up and operate unloading circuits.
10. Install and operate by remote a pilot-operated pressure control valve.
11. Describe transducers
12. Describe electrhydraulic servo valve characteristics.
13. Operate an electrohydraulic servo valve.
14. Install a hydraulic pump and align.
15. Repair a hydraulic cylinder.
16. Choose a hydraulic cylinder for a specific application.
17. Interpret hydraulic schematics.
18. Troubleshoot a hydraulic circuit.
19. Design a hydraulic circuit.
20. Repair valves.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Advanced Pneumatic Systems
470326

Course Description: Design, repair, and troubleshooting of pneumatic systems will be covered in this course.

Prerequisites: Fluid Power-470321
Fluid Power Lab-470325

Content/Process

Students will:

1. Repair a pneumatic cylinder.
2. Choose a pneumatic cylinder for a specific application.
3. Interpret pneumatic schematics.
4. Construct basic air logic circuits.
5. Identify symbols and devices used in air logic circuits.
6. Install and operate a check valve.
7. Install and operate a four-way pilot-operated directional control valve (DCV).
8. Install and operate a push button DCV.
9. Install and operate a cam-operated DCV.
10. Design a pneumatic system.
11. Disassemble an air compressor.
12. Repair valves.
13. Troubleshoot a pneumatic system.
14. Test pneumatic components for proper operation.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Advanced Pneumatic Systems (Lab)
470327

Course Description:
Design, repair, and troubleshooting of pneumatic systems will be covered in this course.

Prerequisites: Fluid Power-470321
Fluid Power Lab-470325
Co-requisite: Advanced Pneumatic Systems - 470326

Content/Process

Students will:

1. Repair a pneumatic cylinder.
2. Choose a pneumatic cylinder for a specific application.
3. Interpret pneumatic schematics.
4. Construct basic air logic circuits.
5. Identify symbols and devices used in air logic circuits.
6. Install and operate a check valve.
7. Install and operate a four-way pilot-operated directional control valve (DCV).
8. Install and operate a push button DCV.
9. Install and operate a cam-operated DCV.
10. Design a pneumatic system.
11. Disassemble an air compressor.
12. Repair valves.
13. Troubleshoot a pneumatic system.
14. Test pneumatic components for proper operation.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Applied Machining I (Ind.Maint)
470360

Course Description:
Consists of intermediate level skills using machining machines and surface grinders. It will include the selection of grinding wheels. Applications in milling, lathe, benchwork, and utilizing gauge blocks and the sine bar are covered in this course. Surface grinding and abrasives are introduced and properties of metals are discussed.

Prerequisite: Fundamentals of Machine Tool A
Fundamentals of Machine Tool B

Content/Process

Students will:

1. Machine and finish holes on the vertical and horizontal mills.
2. Cut and finish different type of keyseats.
3. Select and use different types of milling cutters.
4. Select and perform basic grinding operation.
5. Machine holes on a vertical mill
6. Form mill on a vertical mill
7. Mill key seats
8. Mill an angle on a vertical mill
9. Cut and finish holes on vertical and horizontal mills
10. Demonstrate the care and safe use of machine grinders
11. Select grinding wheels
12. Classify metals and metal shapes.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Basic Blueprint Reading
470302

Course Description:
This course presents basic applied math, lines, multiview drawings, symbols, various schematics and diagrams, dimensioning techniques, sectional views, auxiliary views, threads and fasteners, and sketching typical to all shop drawings. Safety will be emphasized as an integral part of the course.

Prerequisites: None

Content/Process

Students will:

1. Introduction and math review (fractions and decimals)
2. Identify the alphabet of lines
3. Identify multiple views
4. Arrange multiple views
5. Arrange two-view drawings
6. Identify one-view drawings
7. Arrange and identify auxiliary views
8. Demonstrate the use of size and location dimensions
9. Demonstrate proper dimensions of cylinders and arcs
10. Size dimensions of holes and angles
11. Locate dimensions for centering of holes, points, and centers
12. Interpret the base line dimensions on drawings
13. Identify half, full, and removed sections
14. Identify electrical schematic and diagram symbols
15. Identify welding symbols and equipment
16. Interpret ordinate and tabular dimensions
17. Set tolerances using geometric dimensioning techniques
18. Sketch parts with irregular shapes
19. Sketch oblique views of various parts
20. Sketch and dimension shop drawings
21. Dimension parts using shop notes
22. Calculate tolerances
23. Identify labeling of various screw threads
24. Calculate tapers and machined surfaces
25. Interpret connections and flow of various electrical, hydraulic, and pneumatic schematics and diagrams

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Basic Troubleshooting
470317

Course Description:
This course explores the science of troubleshooting and the importance of proper maintenance procedures; how to work well with others, aids in communication, and trade responsibilities; examines actual troubleshooting techniques, aids in troubleshooting, and how to use schematics and symbols; focuses on specific maintenance tasks such as solving mechanical and electrical problems, breakdown maintenance, and the hows and whys of planned maintenance.

Prerequisites: Industrial Maintenance Electrical Principles-470322
Industrial Maintenance Electrical Principles-470323

Content/Process

Students will:

1. Explain the reason efficient troubleshooting is important in a production plant
2. List the steps in troubleshooting a machine/system
3. Demonstrate good communication skills when dealing with plant personnel
4. List the questions that should be asked when a machine system fails
5. List the questions that should be asked when a machine/system fails
6. List the signs of a machine in need of service
7. List the information that should be recorded in a machine equipment record
8. Identify calibration standards
9. Identify different troubleshooting test equipment
10. Use schematics when troubleshooting
11. Identify differences in schematics when troubleshooting
12. Use a troubleshooting chart
13. Identify bearing wear problems
14. Identify pump failure problems and solutions
15. Identify types of hosing
16. Identify current voltage charateristics of wire
17. Apply all safety rules when working with electrical equipment
18. Identify a pictorial diagram, a blocking diagram, and a schematic diagram
19. Demonstrate how to troubleshoot an electrical problem
20. List preventive maintenance procedures.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Blueprint Reading for Machinists
470921

Course Description:
Provides the student with a beginning and advanced series of lectures, demonstrations, and practice exercise in the study of prints. Safety will be emphasized as an integral part of this course.

Prerequisites: None

Content/Process

Students will:

1. Demonstrate competency in mathematical fraction and decimal problems.
2. Identify the alphabet of lines.
3. Identify multiple views.
4. Arrange multiple views.
5. Arrange two view drawings.
6. Identify one view drawings.
7. Arrange and identify auxiliary views.
8. Demonstrate the use of size and location dimensions.
9. Demonstrate proper dimensions of cylinders and arcs.
10. Size dimensions of holes and angles.
11. Locate dimensions for centering of holes, points, and centers.
12. Interpret the base line dimensions on drawings.
13. Calcualte tolerances.
14. Identify labeling of various screw threads.
15. Calculate tapers and machined surfaces.
16. Dimension parts using shop notes.
17. Identify half, full,and removed sections.
18. Interpret ordinate and tabular dimensions.
19. Set tolerances using geometric dimensioning techniques.
20. Sketch parts with irregular shapes.
21. Sketch oblique views of various parts.
22. Sketch and dimension shop drawings.
23. Demonstrate visualizing techniques of multiple views.
24. Identify line types used in combinations.
25. Identify standards listings on working drawings.
26. List procedural machining and construction requirements from notations on working drawings.
27. List proper procedure for construction of various machining processes.
28. Determine proper thread series and types for duty specific assembly.
29. Specify duty specific uses of contour notes.
30. Determine overall measurements of contoured parts.
31. Explain various terms involved in multiple sections.
32. Identify usages for chamfers and interpret sizes.
33. Define various chamfer terms.
34. Determine the sizing procedures of necks and grooves.
35. Identify various keyway and keyseat standards.
36. Identify usage of geometric symbols.
37. Define terms relating to geometric tolerancing.
38. Set standards and tolerances using geometric dimensioning.
39. Set axis coordinates on numerical control prints.
40. Determine axis coordinates on ordinate and tabular prints.
41. Identify casting and forging terms.
42. Calculate bend setbacks in sheet metals and plate steels.
43. Identify parts and materials from various reference books and manuals.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Cooling & Dehumidification (Ind.Maint)
470361

Course Description:

This course explores the science of troubleshooting and the importance of proper maintenance procedures; how to work well with others, aids in communication, and trade responsibilities; examines actual troubleshooting techniques, aids in troubleshooting, and how to use schematics and symbols; focuses on specific maintenance tasks such as solving mechanical and electrical problems, breakdown maintenance, and the hows and whys of planned maintenance.

Prerequisites: Refrigeration Fundamentals-470349
Refrigeration Fundamentals Lab-470350
Corequisites: ACR 250 Cooling & Dehumidification Lab-470362

Content/Process

Students will:

1. Practice/observe safety procedures/techniques
2. Describe "air conditioning"
3. List the benefits of "conditioned" air
4. Describe some of today's current issues regarding air conditioning - industry concerns and future ramifications
5. Describe the difference between "split systems" and "package systems"
6. Describe the sequence of the basic refrigeration cycle and operation of the air conditioning system
7. Use and read various tools and instrumentation needed for checking, testing, and operating air conditioning systems
8. Define the types of condensers: air cooled, water cooled, evaporative
9. Adjust the air flow for proper temperature difference
10. Describe maintenance of a condenser and a cooling tower
11. Analyze air conditioning systems and appropriately diagnose the electrical and/or mechanical problems
12. Demonstrate good customer relations in a classroom simulation
13. Explain the importance of manufacturers' installation and operation requirements
14. Determine equipment electrical requirements
15. Verify equipment air flow and distribution requirements
16. Check operation of all electrical components including control components
17. Demonstrate the use of tools and test equipment
18. Check system operation while following all safety procedures
19. Follow local codes and ordinances during installation and repair
20. Read and demonstrate understanding of electrical wiring diagrams
21. Develop a systematic way to diagnose system problems and demonstrate in class
22. Determine the cause of failure in a system
23. Identify and describe possible causes of failure and how to eliminate them
24. Demonstrate the use of tools and test equipment while following safety practices
25. Verify system operation
26. Write a service report
27. Identify types of control systems: electromechanical, pneumatic, electronic, and programmable
28. Identify control system components
29. Describe the sequences of operation in all types of control systems
30. Construct a schematic diagram using all components necessary to safely operate an air conditioner
31. Program a programmable thermostat for heating, cooling, and heat pump operation including set up and set back
32. Plot and chart psychrometric terms.
33. Describe operation of electronic air cleaners.
34. Measure pressure drop with a magnahelic gauge.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Cooling & Dehumidification (lab) (Ind.Maint)
470362

Course Description:

This course explores the science of troubleshooting and the importance of proper maintenance procedures; how to work well with others, aids in communication, and trade responsibilities; examines actual troubleshooting techniques, aids in troubleshooting, and how to use schematics and symbols; focuses on specific maintenance tasks such as solving mechanical and electrical problems, breakdown maintenance, and the hows and whys of planned maintenance.

Prerequisites: Refrigeration Fundamentals-470349
Refrigeration Fundamentals Lab-470350
Corequisites: ACR 251 Cooling & Dehumidification-470361

Content/Process

Students will:

1. Practice/observe safety procedures/techniques
2. Describe "air conditioning"
3. List the benefits of "conditioned" air
4. Describe some of today's current issues regarding air conditioning - industry concerns and future ramifications
5. Describe the difference between "split systems" and "package systems"
6. Describe the sequence of the basic refrigeration cycle and operation of the air conditioning system
7. Use and read various tools and instrumentation needed for checking, testing, and operating air conditioning systems
8. Define the types of condensers: air cooled, water cooled, evaporative
9. Adjust the air flow for proper temperature difference
10. Describe maintenance of a condenser and a cooling tower
11. Analyze air conditioning systems and appropriately diagnose the electrical and/or mechanical problems
12. Demonstrate good customer relations in a classroom simulation
13. Explain the importance of manufacturers' installation and operation requirements
14. Determine equipment electrical requirements
15. Verify equipment air flow and distribution requirements
16. Check operation of all electrical components including control components
17. Demonstrate the use of tools and test equipment
18. Check system operation while following all safety procedures
19. Follow local codes and ordinances during installation and repair
20. Read and demonstrate understanding of electrical wiring diagrams
21. Develop a systematic way to diagnose system problems and demonstrate in class
22. Determine the cause of failure in a system
23. Identify and describe possible causes of failure and how to eliminate them
24. Demonstrate the use of tools and test equipment while following safety practices
25. Verify system operation
26. Write a service report
27. Identify types of control systems: electromechanical, pneumatic, electronic, and programmable
28. Identify control system components
29. Describe the sequences of operation in all types of control systems
30. Construct a schematic diagram using all components necessary to safely operate an air conditioner
31. Program a programmable thermostat for heating, cooling, and heat pump operation including set up and set back
32. Plot and chart psychrometric terms.
33. Describe operation of electronic air cleaners.
34. Measure pressure drop with a magnahelic gauge.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

CO-OP I (Ind.Maint)
470305

Course Description:
Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Prerequisite: Permission of Instructor

Content/Process

Students will:

1. Gain career awareness and the opportunity to test career choice(s)
2. Receive work experience related to career interests prior to graduation
3. Integrate classroom studies with work experience
4. Receive exposure to facilities and equipment unavailable in a classroom setting
5. Increase employability potential after graduation
6. Earn funds to help finance education expenses

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

CO-OP II (Ind.Maint)
470306

Course Description:
Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Prerequisite: Permission of Instructor

Content/Process

Students will:

1. Gain career awareness and the opportunity to test career choice(s)
2. Receive work experience related to career interests prior to graduation
3. Integrate classroom studies with work experience
4. Receive exposure to facilities and equipment unavailable in a classroom setting
5. Increase employability potential after graduation
6. Earn funds to help finance education expenses

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

CO-OP III (Ind.Maint)
470307

Course Description:
Cooperative Education provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Cooperative Education program receive compensation for their work.

Prerequisite: Permission of Instructor

Content/Process

Students will:

1. Gain career awareness and the opportunity to test career choice(s)
2. Receive work experience related to career interests prior to graduation
3. Integrate classroom studies with work experience
4. Receive exposure to facilities and equipment unavailable in a classroom setting
5. Increase employability potential after graduation
6. Earn funds to help finance education expenses

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Electrical Components (Ind.Maint)
470358

Course Description:
This course defines the electrical components of an air conditioning system. Different types of line voltages, wiring diagrams, and solid-state devices are included. Safety is emphasized.

Prerequisites: HVAC Electricity (Ind. Maint.)-470365
HVAC Electricity Lab (Ind. Maint.)-470366
Co-requisite: ACR 131 Electrical Components Lab-470359

Content/Process

Students will:

1. Practice/observe safety procedures/techniques
2. Measure voltage with digital and analog voltmeters
3. Measure AC current with a clamp-on ammeter
4. Measure resistance with an ohmmeter
5. Check winding insulation with a megohmmeter
6. Check voltage with a voltage tester
7. Use a continuity tester to determine whether an open circuit exists
8. Use a capacitance meter to measure capacitance of both run and start capacitors
9. Define watts, ohms, volts, amps
10. Define and compare single and multi-phase voltage and current
11. Demonstrate proper use of ohmmeter, ammeter, voltmeter
12. Calculate electrical circuit loads
13. Use appropriate meters to check fuses and breakers
14. Use appropriate meter to determine wattage, resistance, voltage, and amperage
15. Interpret tables and charts from National Electrical Code (NEC)
16. Figure wire sizes and voltage drop
17. Draw and identify power transformer types
18. Use electrical meters appropriately to test and identify voltages and phase
19. Size and test fuses and breakers and safely replace them
20. Use NEC tables to size EMT
21. Define relays, sequencers, contactors, capacitors, defrost timers, crankcase heaters, water valves, damper actuators, thermostats, controllers, rheostats, zone valves, solenoids
22. Explain the operation and application of: split phase motors, three phase motors, variable speed motors, shaded pole motors, and permanent split capacitor motors
23. Demonstrate proper use of testing equipment for motors
24. Interpret detailed instructions for wiring circuits
25. Draw electrical circuits in accordance with standard wiring procedures
26. Wire actual electrical circuits from wiring diagrams
27. Demonstrate the use and understanding of basic electrical meters by wiring and testing actual circuits
28. Explain the use of various electrical components in HVACR
29. Interpret schematic wiring diagrams into a sequence of operation for HVACR equipment
30. Analyze the electrical performance of each component and control
31. Rewire a HVACR unit using a schematic diagram
32. Develop an approved routine for electrical troubleshooting

33. Use electrical test instruments appropriately to test and correct the performance of electrical systems.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Electrical Components Lab (Ind.Maint)
470359

Course Description:
In the laboratory, students practice using the different types of line voltages, reading wiring diagrams, and using solid-state devices. Safety is emphasized.

Prerequisite: HVAC Electricity (Ind. Maint.)-470365
HVAC Electricity Lab (Ind. Maint.)-470366
Co-requisite: ACR 130 Electrical Components – 470358

Content/Process

Students will:

1. Practice/observe safety procedures/techniques
2. Measure voltage with digital and analog voltmeters
3. Measure AC current with a clamp-on ammeter
4. Measure resistance with an ohmmeter
5. Check winding insulation with a megohmmeter
6. Check voltage with a voltage tester
7. Use a continuity tester to determine whether an open circuit exists
8. Use a capacitance meter to measure capacitance of both run and start capacitors
9. Define watts, ohms, volts, amps
10. Define and compare single and multi-phase voltage and current
11. Demonstrate proper use of ohmmeter, ammeter, voltmeter
12. Calculate electrical circuit loads
13. Use appropriate meters to check fuses and breakers
14. Use appropriate meter to determine wattage, resistance, voltage, and amperage
15. Interpret tables and charts from National Electrical Code (NEC)
16. Figure wire sizes and voltage drop
17. Draw and identify power transformer types
18. Use electrical meters appropriately to test and identify voltages and phase
19. Size and test fuses and breakers and safely replace them
20. Use NEC tables to size EMT
21. Define relays, sequencers, contactors, capacitors, defrost timers, crankcase heaters, water valves, damper actuators, thermostats, controllers, rheostats, zone valves, solenoids
22. Explain the operation and application of: split phase motors, three phase motors, variable speed motors, shaded pole motors, and permanent split capacitor motors
23. Demonstrate proper use of testing equipment for motors
24. Interpret detailed instructions for wiring circuits
25. Draw electrical circuits in accordance with standard wiring procedures
26. Wire actual electrical circuits from wiring diagrams
27. Demonstrate the use and understanding of basic electrical meters by wiring and testing actual circuits
28. Explain the use of various electrical components in HVACR
29. Interpret schematic wiring diagrams into a sequence of operation for HVACR equipment
30. Analyze the electrical performance of each component and control
31. Rewire a HVACR unit using a schematic diagram
32. Develop an approved routine for electrical troubleshooting

33. Use electrical test instruments appropriately to test and correct the performance of electrical systems.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Fluid Power
470321

Course Description:
This course is a study of fluid power theory, component identification and application, schematic reading, and basic calculations related to pneumatic and hydraulic systems and their operations.

Co-requisite: Fluid Power Lab-470325

Content/Process

Students will:

1. Design simple hydraulic and pneumatic systems
2. Draw hydraulic and pneumatic circuits
3. Install pneumatic pressure regulator
4. Check and replace pneumatic pressure regulator
5. Install pressure relief valve
6. Check and replace pressure relief valve
7. Install non-rotating cylinder
8. Install hydraulic and pneumatic motors
9. Install pressure booster (intensifier)
10. Install pressure reducing valve
11. Install rotating cylinder
12. Replace 2-way, 3-way, and 4-way valves (solenoid operated valves)
13. Replace an accumulator
14. Adjust the pressure on hydraulic systems
15. Change filters in hydraulic systems
16. Change hydraulic fluid
17. Install hydraulic pressure regulator
18. Check and replace hydraulic pressure regulator
19. Install hydraulic sequence valve
20. Check and replace hydraulic sequence valve
21. Install counter-balance valve
22. Install flow control or speed control valve
23. Install hydraulic pump
24. Replace hydraulic cylinder

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Fluid Power Lab
470325

Course Description:
This course is a study of fluid power theory, component identification and application, schematic reading, and basic calculations related to pneumatic and hydraulic systems and their operations.

Co-requisite: Fluid Power-470321

Content/Process

Students will:

1. Design simple hydraulic and pneumatic systems
2. Draw hydraulic and pneumatic circuits
3. Install pneumatic pressure regulator
4. Check and replace pneumatic pressure regulator
5. Install pressure relief valve
6. Check and replace pressure relief valve
7. Install non-rotating cylinder
8. Install hydraulic and pneumatic motors
9. Install pressure booster (intensifier)
10. Install pressure reducing valve
11. Install rotating cylinder
12. Replace 2-way, 3-way, and 4-way valves (solenoid operated valves)
13. Replace an accumulator
14. Adjust the pressure on hydraulic systems
15. Change filters in hydraulic systems
16. Change hydraulic fluid
17. Install hydraulic pressure regulator
18. Check and replace hydraulic pressure regulator
19. Install hydraulic sequence valve
20. Check and replace hydraulic sequence valve
21. Install counter-balance valve
22. Install flow control or speed control valve
23. Install hydraulic pump
24. Replace hydraulic cylinder

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Fundamentals of Machine Tool – A (Ind.Maint)
470313

Course Description:
This course provides the basic principles needed for a solid foundation in machine tool technology. Areas and machines covered include shop safety, bench-work, drill press, power saw, measurement, mills, and lathes.

Prerequisites: None

Content/Process

Students will:

1. Demonstrate and practice safe work habits in the lab area. As outlined in NIMS Framework for Machining Skills.
2. Perform bench work processes, hacksaw, files, layout, drill, tap and other activities to meet industry standards.
3. Perform safe and functional activities on the following machines: horizontal bandsaw, vertical bandsaw, drill press, arbor press, lathes, and mills.
4. Perform tasks with cutting hand tools and non-cutting hand tools.
5. Identify and explain the handling procedure for hazardous material and the content of MSDS.
6. Identify safety needs and regulations in a machine shop.
7. Identify non-cutting hand tools and the proper use of them.
8. Prepare for a benchwork process
9. Hand saw with a hacksaw
10. Bench file the workpiece
11. Dress and true grinding wheels on bench and pedestal grinders
12. Demonstrate knowledge of power saws, parts, and applications
13. Demonstrate the care and safe use of the power saw
14. Cut and weld bandsaw blades
15. Perform operations on the cut-off saw
16. Perform operations on the vertical band saw
17. Demonstrate knowledge of drill press, parts, and applications
18. Demonstrate the care and safe use of the drill press
19. Calculate and set the cutting speed and feed on the drill press
20. Sharpen drills
21. Set up a drill press and drill holes
22. Shape and finish holes on a drill press
23. Tap holes by hand and machine on a drill press
24. Thread by hand with taps and dies
25. Operate an arbor press
26. Use chisels and punches
27. Demonstrate knowledge of hazardous materials handling
28. Demonstrate knowledge of hazardous materials storage
29. Demonstrate lock-out/tag-out procedures
30. Demonstrate use of MSDS
31. Measure with basic hand held measuring instruments.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Fundamentals of Machine Tool – B (Ind.Maint)
470314

Course Description:
This course provides the basic principles needed for a solid foundation in machine tool technology. Areas and machines covered include shop safety, bench-work, drill press, power saw, measurement, mills, and lathes.

Prerequisites: Fundamentals of Machine Tool A-470313

Content/Process

Students will:

1. Demonstrate and practice safe work habits in the lab area.
2. Demonstrate knowledge of lathes, parts, and applications
3. Demonstrate the care and safe use of lathes
4. Demonstrate use and knowledge of mill parts and applications.
5. Demonstrate knowledge of cutting tools.
6. Demonstrate knowledge of cutting fluids.
7. Identify and explain the handling procedure for hazardous material and the content of MSDS.
8. Calculate and set speeds and feeds on a lathe
9. Sharpen high speed tool bits
10. Mount workpiece on a lathe
11. Face a workpiece
12. Perform turning operations
13. Machine with carbide cutting tools
14. File and polish a workpiece
15. Demonstrate knowledge of a milling machine, parts, and applications
16. Demonstrate the care and safe use of milling machines
17. Calculate and set speeds and feeds on the milling machine
18. Mill flat surfaces and grooves using a vertical mill
19. Apply cutting fluid to machining operations

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Heating and Humidification (Ind. Maint.)
470363

Course Description:
Explains heating systems from simple fossil fuel furnaces through more complex systems. This course will also concentrate on the line and control voltage circuitry pertaining to these systems. ARI Controls: Subtopics A-C; Heating Systems: Subtopics A-C; System Installation and Start-Up: Subtopics A and B; System Servicing and Troubleshooting: Subtopic C; Tools and Equipment: Subtopic D.

Prerequisite: HVAC Electricity/Lab (Ind.Maint.)-470365/66
Co-requisites: Heating and Humidification Lab (Ind. Maint.)-470364

Content/Process

Students will:

1. Practice/observe safety procedures/techniques
2. Adjust valves
3. Check coil resistance of a valve coil
4. Test gas valve operation
5. Check the voltage at gas valve operator
6. Check pressure at inlet vs. outlet of gas valve
7. Perform a regular conversion on a gas valve from natural gas to LP or reverse: low, line voltage, redundant, two-stage, and modulating
8. Explain the operation of a solenoid valve
9. Explain direct vs. servo regulation
10. Identify limited, non-adjustable and adjustable regulators
11. Determine application of gas valves
12. Differentiate between pilot proving devices
13. Explain the operation of flame rod, mercury flame switch, bimetal, and millivolt flame sensors
14. Test and change a thermocouple flame sensor
15. Test spark ignition modules
16. Perform safety lockout procedures for burners
17. Measure resistance of a cad cell during operation
18. Explain the operation of an oil delay valve
19. Identify and install residential heating and cooling thermostats
20. Test a fan/limit control to identify a set point of control
21. Wire a complete heating system - line and low voltage
22. Identify controls for heating and cooling
23. Wire a humidistat into electrical circuit
24. Wire control circuit for electronic air cleaner
25. Test and adjust the fuel system of furnace
26. Check the ignition system
27. De-rate or change over a gas burner
28. Adjust burner system to recommended efficiency
29. Check for proper temperature rise across the furnace
30. Test all safety controls

31. Set proper air distribution in house
32. Remove, install, and adjust blower motor and/or belt
33. Clean the pilot assembly
34. Adjust the regulator
35. Observe proper draft conditions
36. Oil motor(s) and bearings
37. Check and adjust the heat anticipator
38. Check circulator for alignment and lubrication
39. Set aquastat
40. Check water-regulating valve operator
41. Inspect/change zone valve operator
42. Remove air from water system
43. Wire a multizone/multipump hydronic system
44. Identify types of hydronic piping systems
45. Test boiler efficiency and clean if necessary
46. Oil motor(s)
47. Check and adjust the heat anticipator
48. Perform pressure checks on the fuel system
49. Perform pressure checks on the venting system
50. Measure temperature difference across heating and cooling equipment
51. Adjust individual register outlets to properly balance system
52. Describe the reasons for codes
53. Discuss three model codes: Boca, standard, uniform
54. Identify the codes and standards for the applicable area, locality, or state
55. Discuss the relationship between codes and manufacturers' installation instructions
56. Identify standards not covered by codes: ARI, ASHRAE, SMACNA
57. Demonstrate good customer relations in a classroom simulation
58. Explain the importance of manufacturers' installation and operation requirements
59. Determine equipment electrical requirements
60. Verify equipment air flow and distribution requirements
61. Check operation of all electrical control components
62. Check operation of gas train components and measurements
63. Demonstrate use of tools and instruments
64. Check oil burner components and measurements
65. Check ignition systems while following all safety principles
66. Evaluate fuel supply systems
67. Test for proper combustion
68. Check electrical components for operation and wiring connections
69. Check for correct heating input and adjust to manufacturers' specifications
70. Read electrical wiring diagrams and demonstrate an understanding of wiring diagrams
71. Use tools and test equipment appropriately while following safety practices
72. Demonstrate an understanding of combustion theory
73. Determine air requirements
74. Develop a systematic way to diagnose system problems and demonstrate in class
75. Determine cause of failure in a heating system
76. Identify and describe all possible causes of failure and how to eliminate causes

77. Verify system operation
78. Write a service report
79. Measure chimney draft with a draft gauge
80. Perform an efficiency test on an oil-gas burner: smoke test, CO2 test, and 02 test
81. Determine the efficiency of an oil pump using a vacuum gauge and a pressure gauge
82. Determine the relative humidity using a sling psychrometer
83. Measure gas pressure with a U-tube manometer

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Heating and Humidification (lab)
470364

Course Description:

This course is designed to develop the practical skills of troubleshooting, checking, adjusting, and installing heating units currently in use.

Prerequisite: HVAC Electricity (Ind.Maint.)-4703--
HVAC Electricity Lab (Ind.Maint.)-4703--
Co-requisite: Heating and Humidification (Ind. Maint.)-4703--

Content/Process

Students will:

1. Practice safe work procedures in lab and classroom.
2. See tasks list (1-83) for ACR 260

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

HVAC Electricity (Ind.Maint)
470365

Course Description:
This course introduces students to the basic physics of electricity. Students apply Ohm's law; measure resistance, voltage, ohms, watts and amps; construct various types of electrical circuits; select wire and fuse sizes; and learn to troubleshoot an electric motor and motor controls.

Prerequisites: None

Content/Process

Students will:

1. Practice electrical safety
2. Measure ohms with an ohmmeter
3. Measure voltage with a voltmeter
4. Measure amps with an ammeter
5. Measure watts with a wattmeter
6. Solve electrical circuit problems using Ohm's Law
7. Draw and interpret electrical symbols
8. Construct series circuits
9. Construct parallel circuits
10. Construct series-parallel circuits
11. Connect, operate, and identify the types of single-phase motors
12. Measure the resistance of windings in a split-phase motor and identify the start/run windings
13. Test capacitors
14. Select wire and fuse sizes
15. Test transformers
16. Locate faults in electrical circuits
17. Identify types of 3-phase power supplies
18. Troubleshoot magnetic motor starters and coils

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO’s - SkillsUSA

HVAC Electricity Lab (Ind.Maint)
470366

Course Description:
This course introduces students to the basic physics of electricity. Students apply Ohm's law; measure resistance, voltage, ohms, watts and amps; construct various types of electrical circuits; select wire and fuse sizes; and learn to troubleshoot an electric motor and motor controls.

Co-requisites: HVAC Electricity (Ind.Maint.)-470365

Content/Process

Students will:

1. Practice electrical safety
2. Measure ohms with an ohmmeter
3. Measure voltage with a voltmeter
4. Measure amps with an ammeter
5. Measure watts with a wattmeter
6. Solve electrical circuit problems using Ohm's Law
7. Draw and interpret electrical symbols
8. Construct series circuits
9. Construct parallel circuits
10. Construct series-parallel circuits
11. Connect, operate and identify the types of single-phase motors
12. Measure the resistance of windings in a split-phase motor and identify the start/run windings
13. Test capacitors
14. Select wire and fuse sizes
15. Test transformers
16. Locate faults in electrical circuits
17. Identify types of 3-phase power supplies
18. Troubleshoot magnetic motor starters and coils

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO’s - SkillsUSA

Industrial Maintenance Electrical Motor Controls
470348

Course Description:
This course addresses the diversity of electric motor control devices and applications used in industry today with safety and electrical lockouts included.

Prerequisite: Industrial Maintenance Electrical Principles-470322
Industrial Maintenance Electrical Lab -470323

Content/Process

Students will:

1. Connect control relay systems
2. Connect a dynamic breaking circuit for AC motors
3. Test magnetic starters
4. Connect overload relays into starting control circuits
5. Connect reduced voltage starters
6. Connect time delay relays
7. Connect motor for automatic controls
8. Connect automatic reduced voltage starter for DC motor control
9. Connect control relay systems
10. Connect limit switches
11. Connect motor control circuits for plug-ins
12. Connect point starters for DC motors
13. Connect push button stations
14. Connect selector switches
15. Connect sensing devices (non-electric)
16. Connect magnetic starters

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Industrial Maintenance Electrical Motor Controls I (Lab)
470347

Course Description:
This course addresses the diversity of electric motor control devices and applications used in industry today with safety and electrical lockouts included.

Prerequisite: Industrial Maintenance Electrical Principles-470322
Industrial Maintenance Electrical Lab -470323
Co-requisite: **Industrial Maintenance Electrical Motor Controls - 470348**

Content/Process

Students will:

1. Connect control relay systems.
2. Connect a dynamic breaking circuit for AC motors.
3. Test magnetic starters.
4. Connect overload relays into starting control circuits.
5. Connect reduced voltage starters.
6. Connect time delay relays.
7. Connect motor for automatic controls.
8. Connect automatic reduced voltage starter for DC motor control.
9. Connect control relay systems.
10. Connect limit switches.
11. Connect motor control circuits for plugging.
12. Connect point starters for DC motors.
13. Connect push-button stations.
14. Connect selector switches.
15. Connect sensing devices (non-electric).
16. Connect magnetic starters.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Industrial Maintenance Motor Control Concepts (Ind.Maint)
470333

Course Description:
Verifies knowledge of basic theory by making measurements in working AC and DC circuits. Various types of circuits are constructed and their parameters measured. The use of test equipment, safety, and troubleshooting are stressed. This lab course also provides practical experience in the construction, operation, and maintenance of AC and DC motors.

Prerequisites: Industrial Maintenance Electrical Principles-470322
Industrial Maintenance Electrical Lab -470323

Content/Process

Students will:

1. Connect control relay systems.
2. Connect dynamic breaking circuits for AC motors.
3. Test magnetic starters.
4. Connect overload relays into starting control circuits.
5. Connect reduced voltage starters.
6. Connect time delay relays.
7. Connect a motor for automatic controls.
8. Connect an automatic reduced voltage starter or DC motor control.
9. Connect limit switches.
10. Connect motor control circuits for plugging.
11. Connect point starters for DC motors.
12. Connect push button stations.
13. Connect selector switches.
14. Connect sensing devices (non-electric).
15. Connect magnetic starters.
16. Describe basic operation of programmable controllers.
17. Fabricate I/O configurations using serial and parallel.
18. Design simple programmable controller applications.
19. Program PLCs.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Industrial Maintenance Motor Control Concepts (Lab) (Ind.Maint)
470334

Course Description:

Verifies knowledge of basic theory by making measurements in working AC and DC circuits. Various types of circuits are constructed and their parameters measured. The use of test equipment, safety, and troubleshooting are stressed. This lab course also provides practical experience in the construction, operation, and maintenance of AC and DC motors.

Prerequisites: Industrial Maintenance Electrical Principles-470322
Industrial Maintenance Electrical Lab -470323
Co-requisite: Motor Control Concepts-470333

Content/Process

Students will:

1. Connect control relay systems
2. Connect dynamic breaking circuits for AC motors.
3. Test magnetic starters.
4. Connect overload relays into starting control circuits.
5. Connect reduced voltage starters.
6. Connect time delay relays.
7. Connect a motor for automatic controls.
8. Connect an automatic reduced voltage starter for DC motor control.
9. Connect limit switches.
10. Connect motor control circuits for plugging.
11. Connect point starters for DC motors.
12. Connect push button stations.
13. Connect selector switches.
14. Connect sensing devices (non-electric).
15. Connect magnetic starters.
16. Describe basic operation of programmable controllers.
17. Fabricate I/O configurations using serial and parallel.
18. Design simple programmable controller applications.
19. Program PLCs.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Industrial Maintenance of PLC's
470330

Course Description:
This course includes the theory of Programmable Logic Controllers to include installation, programming, interfacing, and troubleshooting PLC's
.
Prerequisite: Motor Control Concepts-470333
Motor Control Concepts Lab-470334

Content/Process

Students will:

1. Describe basic operation of programmable controllers
2. Apply language functions and symbols used in PLC
3. Translate relay logic to PLC logic
4. Fabricate I/O configurations using serial and parallel.
5. Design simple programmable controller applications
6. Program PLCs
7. Install PLCs to replace relay systems
8. Install PLCs to operate fluid power systems
9. Plan to shutdown procedure for PLC-managed equipment
10. Troubleshoot hardware faults using PLCs

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Industrial Maintenance of PLC's Lab
470331

Course Description:
This course includes the theory of Programmable Logic Controllers to include installation, programming, interfacing, and troubleshooting PLC's.

Prerequisite: Motor Control Concepts-470333
Motor Control Concepts Lab-470334
Co-requisite: **Industrial Maintenance of PLC's -470330**

Content/Process

Students will:

1. Apply language functions and symbols used in PLC.
2. Translate relay logic to PLC logic.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

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Industrial Maintenance Electrical Principles
470322

Course Description:
This course introduces the theory of electricity and magnetism and the relationship of voltage, current, resistance, and power in electrical circuits. The course is designed to develop an understanding of alternating and direct current fundamentals. Students will apply formulas to analyze the operation of AC and DC circuits.

Prerequisite: None

Content/Process

Students will:

1. Apply shop and electrical safety practices/OSHA Standards
2. National Electrical Code
3. Care for, maintain, identify and use basic hand tools
4. Solder/de-solder electrical connections
5. Set up and operate power supplies
6. Compute, measure, and identify conductance and resistance of conductors and insulators
7. Measure properties of a circuit using VOM and DMM meters
8. Solve electrical circuit problems using Ohm's Law
9. Analyze, construct and troubleshoot parallel circuits
10. Analyze, construct and troubleshoot series circuits
11. Analyze, construct and troubleshoot series-parallel circuits
12. Determine physical and electrical characteristics of capacitors and inductors
13. Write technical reports
14. Use an oscilloscope to verify properties of an AC signal
15. Determine physical and electrical characteristics of transformers and test procedures
16. Compute and measure power in AC circuits
17. Apply and demonstrate the Edison system
18. Apply and demonstrate the three phase system
19. Analyze and identify circuit protection
20. Connect various transformer configuration
21. Wire two- and three-way switches
22. Wire single phase circuit
23. Install, identify & label circuit breakers, fuses & other overload protection in distribution panels
24. Identify appropriate wiring sizes and amperage ratings
25. Identify & install appropriate wiring techniques
26. Install conductors in various forms of conduit

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Industrial Maintenance Electrical Principles (Lab)
470323

Course Description:
This course introduces the theory of electricity and magnetism and the relationship of voltage, current, resistance, and power in electrical circuits. The course is designed to develop an understanding of alternating and direct current fundamentals. Students will apply formulas to analyze the operation of AC and DC circuits.

Co-requisite: Industrial Maintenance Electrical Principles -470322

Content/Process

Students will:

1. Apply shop and electrical safety practices.
2. Identify and use basic hand tools.
3. Care for and maintain hand tools.
4. Solder/de-solder electrical connections.
5. Set up and operate power supplies.
6. Compute, measure, and identify conductance and resistance of conductors and insulators.
7. Measure properties of a circuit using VOM and DMM meters.
8. Solve electrical circuit problems using Ohm's Law.
9. Analyze, construct and troubleshoot parallel circuits.
10. Analyze, construct and troubleshoot series circuits.
11. Analyze, construct and troubleshoot series-parallel circuits.
12. Analyze basic motors, generator theory and operation.
13. Write technical reports.
14. Use an oscilloscope to verify properties of an AC signal.
15. Determine physical and electrical characteristics of transformers and test procedures for transformers.
16. Compute and measure power in AC circuits.
17. Apply and demonstrate the Edison system.
18. Apply and demonstrate the three phase system.
19. Analyze and identify circuit protection.
20. Connect various transformer configurations.
21. Wire two- and three-way switches.
22. Wire single phase circuits.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Internship I (Ind.Maint)
470308

Course Description:
The Practicum provides supervised on-the-job work experience related to the student's educational objectives. Students participating in the Practicum do not receive compensation.

Prerequisite: Permission of Instructor

Content/Process

Students will:

1. Gain career awareness and the opportunity to test career choice(s)
2. Receive work experience related to career interests prior to graduation
3. Integrate classroom studies with work experience
4. Receive exposure to facilities and equipment unavailable in a classroom setting
5. Increase employability potential after graduation.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Maintaining Industrial Equipment
470318

Course Description:
This course is designed to introduce the student to maintenance techniques and procedures used to maintain industrial equipment.

Prerequisite: None

Content/Process

Students will:

1. Describe the care and safe use of maintenance tools, equipment and components, e.g., lock-out/tag-out, rigging, electrical safety.
2. Describe lubrication techniques used on machines and components.
3. Identify various types of bearings and seals.
4. Explain the replacement procedure for bearings and seals.
5. Explain alignment of couplings using, e.g., straight edge and feeler gauge, dial indicator methods, and laser.
6. Explain the mounting and operation of centrifugal pumps and motors.
7. Explain the mounting and operation of speed reduction/speed increase assemblies.
8. Explain the mounting and operation of clutch and brake assemblies.
9. Identify common belts, e.g., V-Belt, timing.
10. Explain the tensioning and alignment of various belts.
11. Identify common types chains, e.g., roller, silent.
12. Explain the tensioning and alignment of various chains.
13. Explain the alignment of sprockets and sheaves.
14. Explain the installation and adjustment variable of pitch sheaves.
15. Explain the common types of gears, e.g., spur, helical.
16. Describe the maintenance of open and closed gearing.
17. Explain the diametral pitch and gear meshing.
18. Explain vibration analysis in troubleshooting.
19. Identify various fasteners, key and keyways, and bolts.
20. Explain set-up, lighting and using Oxyfuel cutting equipment.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Maintaining Industrial Equipment (Lab)
470319

Course Description:
This course is designed to provide the student with lab experience in the maintenance of industrial equipment.

Co-requisite: **Maintaining Industrial Equipment - 470318**

Content/Process

Students will:

1. Use maintenance tools, equipment and components safely, e.g., lock-out/tag-out, rigging, electrical safety.
2. Perform lubrication techniques on machines and components.
3. Replace bearings and seals.
4. Align couplings using; straight edge and feeler gauge, dial indicator methods, and laser.
5. Mount and operate centrifugal pumps and motors.
6. Mount and operate speed reduction/speed increase assemblies.
7. Mount and operate clutch and brake assemblies.
8. Adjust tension and alignment of various belts.
9. Adjust tension and alignment of various chains.
10. Align sprockets and sheaves.
11. Install and adjust pitch sheaves.
12. Maintain open and closed gearing.
13. Use vibration analysis in troubleshooting.
14. Perform straight line, piercing, beveling with oxyfuel cutting equipment.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

IMT 240
Industrial Maintenance Motor Control Concepts
470333

Course Description:
Veifies knowledge of basic theory by making measurements in working AC and DC circuits. Various types of circuits are constructed and their parameters measured. The use of test equipment, safety, and troubleshooting are stressted. This lab course also provides practical experience inthe construction, operation, and maintenance of AC and DC motors.
Prerequisites: IMT 110/111

Content/Process

Students will:

1.Connect control relay systems.
2.Connect dynamic breaking circuits for AC motors.
3.Test magnetic starters.
4.Connect overload relays into starting control circuits.
5.Connect reduced voltage starters.
6.Connect time delay relays.
7.Connect a motor for automatic controls.
8.Connect an automatic reduced voltage starter dor DC motor control.
9.Connect limit switches.
10. Connect motor control circuits for plugging.
11.Connect point starters for DC motors.
12. Connect push button stations.
13. Connect selector switches.
14. Connect sensing devices (non-electric).
15. Connect magnetic starters.
16. Describe basic operation of programmable controllers.
17. Fabricate I/O configurations using serial and parallel.
18. Design simple programmable controller applications.
19. Program PLCs.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

IMT 241
Industrial Maintenance Motor Control Concepts/Lab
470334

Course Description:
Veifies knowledge of basic theory by making measurements in working AC and DC circuits. Various types of circuits are constructed and their parameters measured. The use of test equipment, safety, and troubleshooting are stressted. This lab course also provides practical experience inthe construction, operation, and maintenance of AC and DC motors.
Prerequisites: IMT 110/111

Content/Process

Students will:

1.Connect control relay systems.
2.Connect dynamic breaking circuits for AC motors.
3.Test magnetic starters.
4.Connect overload relays into starting control circuits.
5.Connect reduced voltage starters.
6.Connect time delay relays.
7.Connect a motor for automatic controls.
8.Connect an automatic reduced voltage starter dor DC motor control.
9.Connect limit switches.
10. Connect motor control circuits for plugging.
11.Connect point starters for DC motors.
12. Connect push button stations.
13. Connect selector switches.
14. Connect sensing devices (non-electric).
15. Connect magnetic starters.
16. Describe basic operation of programmable controllers.
17. Fabricate I/O configurations using serial and parallel.
18. Design simple programmable controller applications.
19. Program PLCs.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Refrigeration Fundamentals (Ind.Maint)
470349

Course Description:
Introduces the fundamentals of refrigeration, refrigeration terms, and the basic refrigeration cycle. Proper use of tools, test equipment, and materials is stressed. Environmental issues including refrigerant handling are discussed. Refrigerant piping and methods used to join them are taught. General and specific safety is emphasized.

Prerequisites: None

Content/Process

Students will:

1. Practice/observe safety practices/techniques
2. Explain the history of refrigeration
3. Compare the benefits of closed vs. open system
4. Identify and explain the operation of the four major components
5. Identify the high and low sides of the system
6. Define matter and heat
7. Distinguish between the three states of matter
8. Explain the direction and rate of heat flow
9. Describe the three methods of heat transfer
10. Identify the reference points of temperature: boiling point, freezing point, critical temperature, absolute zero
11. Explain the difference between heat and temperature
12. Explain the differences between latent and sensible heat
13. Explain the relationship of pressures and fluids at different temperatures
14. Calculate absolute and gauge pressures
15. Measure absolute and gauge pressures
16. Explain how fluids react in a closed vs. open system
17. Compare temperature with pressure (P/T Chart)
18. Explain why fluids flow
19. Define the properties of refrigerants
20. Explain the uses of different refrigerants
21. Identify color coding of refrigerant cylinders
22. Explain classifications of refrigerants
23. List proper transfer and storage of refrigerants
24. Explain the four parts of the refrigeration cycle
25. Draw a refrigeration system on a pressure-enthalpy (Ph) chart
26. Explain the benefits of superheat and sub cooling
27. Identify the effects of improper refrigerant in a system
28. Identify basic tools and accessories: various screwdrivers, nutdrivers, socket wrenches, Allen (hex) wrenches, open- and box-end wrenches, flare wrench
29. Identify power tools: general-purpose drill, power screwdriver, hammer drill, reciprocating saw, screw-gun, etc.
30. Identify fasteners: bolts, screws, masonry anchors, various electrical connectors, conduit, pipe and cable clamps, nails, etc.
31. Identify pipe and tubing tools: pipe cutters, reamers and threaders, tubing cutters and

reamers, benders, flaring tools, swaging tools, pipe vises, etc.
32. Describe lubrication methods utilizing: grease guns, oilers, sprays
33. Measure pressures with the refrigeration gauge manifold
34. Evacuate systems with a two-stage vacuum pump
35. Measure vacuums with a thermistor vacuum gauge
36. Measure temperatures with various thermometers
37. Charge a system with an electronic charging scale
38. Check for leaks with electronic leak detector dye and electrosonic
39. Identify types of pipe and tubing used in refrigeration work
40. Identify various types of fittings
41. Describe methods of insulating pipe and tubing
42. Identify soldering and brazing alloys used in HVACR
43. Explain applications of soldering and brazing alloys
44. Flare copper tubing
45. Swag copper tubing
46. Bend copper tubing
47. Identify types of torches
48. Solder and braze copper tubing
49. Cut and thread iron pipe
50. Describe heat sink methods
51. Describe heat exchange techniques
52. Explain saturation temperature
53. Determine the METD (Mean Effective Temperature Difference)
54. Check for and repair refrigerant leaks
55. Measure temperatures with bimetal and glass stem thermometers
56. Describe the applications of vibration eliminators
57. Identify types of evaporators: bare-tube, finned, plate, unit coolers, chillers
58. Explain the operation performance of a condenser
59. Charge system with refrigerant on liquid side as well as suction side
60. Test and adjust all operating and safety controls
61. Replace filter driers
62. Inspect electrical circuit for defective connections
63. Repair defective connections
64. Interpret wiring diagram
65. Clean drain line
66. Check all electrical components for voltage and current
67. Check and/or change compressor oil
68. Clean condenser coil surface (air cooled/water cooled)
69. Perform all aspects of preventive maintenance

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Refrigeration Fundamentals (lab) (Ind.Maint)
470350

Course Description:
Develops proper hands-on techniques in the servicing and troubleshooting of basic systems. Proper use and care of tools, equipment, and materials is stressed. Enhances the skills and working knowledge of tubing, fitting, brazing, and soldering. Safety will be emphasized.

Corequisites: **Refrigeration Fundamentals (Ind.Maint)-470349**

Content/Process

Students will:

1. Practice/observe safety practices/techniques
2. Explain the history of refrigeration
3. Compare the benefits of closed vs. open system
4. Identify and explain the operation of the four major components
5. Identify the high and low sides of the system
6. Define matter and heat
7. Distinguish between the three states of matter
8. Explain the direction and rate of heat flow
9. Describe the three methods of heat transfer
10. Identify the reference points of temperature: boiling point, freezing point, critical temperature, absolute zero
11. Explain the difference between heat and temperature
12. Explain the differences between latent and sensible heat
13. Explain the relationship of pressures and fluids at different temperatures
14. Calculate absolute and gauge pressures
15. Measure absolute and gauge pressures
16. Explain how fluids react in a closed vs. open system
17. Compare temperature with pressure (P/T Chart)
18. Explain why fluids flow
19. Define the properties of refrigerants
20. Explain the uses of different refrigerants
21. Identify color coding of refrigerant cylinders
22. Explain classifications of refrigerants
23. List proper transfer and storage of refrigerants
24. Explain the four parts of the refrigeration cycle
25. Draw a refrigeration system on a pressure-enthalpy (Ph) chart
26. Explain the benefits of superheat and sub cooling
27. Identify the effects of improper refrigerant in a system
28. Identify basic tools and accessories: various screwdrivers, nut-drivers, socket wrenches, Allen (hex) wrenches, open- and box-end wrenches, flare wrench
29. Identify power tools: general-purpose drill, power screwdriver, hammer drill, reciprocating saw, screw-gun, etc.
30. Identify fasteners: bolts, screws, masonry anchors, various electrical connectors, conduit, pipe and cable clamps, nails, etc.
31. Identify pipe and tubing tools: pipe cutters, reamers and threaders, tubing cutters and reamers, benders, flaring tools, swaging tools, pipe vises, etc.
32. Describe lubrication methods utilizing: grease guns, oilers, sprays

33. Measure pressures with the refrigeration gauge manifold
34. Evacuate systems with a two-stage vacuum pump
35. Measure vacuums with a thermistor vacuum gauge
36. Measure temperatures with various thermometers
37. Charge a system with an electronic charging scale
38. Check for leaks with electronic leak detector dye and electrosonic
39. Identify types of pipe and tubing used in refrigeration work
40. Identify various types of fittings
41. Describe methods of insulating pipe and tubing
42. Identify soldering and brazing alloys used in HVACR
43. Explain applications of soldering and brazing alloys
44. Flare copper tubing
45. Swag copper tubing
46. Bend copper tubing
47. Identify types of torches
48. Solder and braze copper tubing
49. Cut and thread iron pipe
50. Describe heat sink methods
51. Describe heat exchange techniques
52. Explain saturation temperature
53. Determine the METD (Mean Effective Temperature Difference)
54. Check for and repair refrigerant leaks
55. Measure temperatures with bimetal and glass stem thermometers
56. Describe the applications of vibration eliminators
57. Identify types of evaporators: bare-tube, finned, plate, unit coolers, chillers
58. Explain the operation performance of a condenser
59. Charge system with refrigerant on liquid side as well as suction side
60. Test and adjust all operating and safety controls
61. Replace filter driers
62. Inspect electrical circuit for defective connections
63. Repair defective connections
64. Interpret wiring diagram
65. Clean drain line
66. Check all electrical components for voltage and current
67. Check and/or change compressor oil
68. Clean condenser coil surface (air cooled/water cooled)
69. Perform all aspects of preventive maintenance

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO’s - SkillsUSA

Robotics and Industrial Automation (Ind.Maint)
470351

Course Description:
Introduction to the theory of robots including terminology, components, and basic programming. Provides theory of serve and non-servo robots. Topics include robot types, controllers, manipulators, basic robotic programming, and fluid power systems. Provides basic theory of flexible and computer-integrated manufacturing and control systems.

Prerequisites: Motor Control Concepts-470333

Content/Process

Students will:

1. Explain the set-up, repair, and maintenace of automatic machines.
2. Explain the set-up, repair, and maintenance of processing equipment.
3. Explain the set-up, repair, and maintenance of robots that work together as part of a total automated manufacturing system.
4. Develop cost/benefit analysis for automation.
5. Develop case stuides for improving production, efficiency, and profitability.
6. Anaylze, summarize, and interpret major factors in automation to include operator training, teamwork, resistance, and organized labor.
7. Analyze and develop safety strategies for automated systems.
8. Develop on-line and off-line robot programs.
9. Describe components in the integrated manufacturing environment.
10. Demonstrate knowledge of robot terminology.
11. Read and understand technical manuals.
12. Explain how to perform preventative maintenance.
13. Identify and describe the functions of vision systems.
14. Describe open loop and closed loop control.
15. Demonstrate knowledge of servo and non-servo systems.
16. Demonstrate knowledge of robot classifications.
17. Define computer-integrated manufacturing (CIM) systems.
18. Develop a safety strategy for automated work cells. Include: risk assessment and risk reduction.
19. Demonstrate leadership skills.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Robotics and Industrial Automation Lab-A (Ind.Maint)
470352

Course Description:
Introduction to the theory of robots including terminology, components, and basic programming. Provides theory of serve and non-servo robots. Topics include robot types, controllers, manipulators, basic robotic programming, and fluid power systems. Provides basic theory of flexible and computer-integrated manufacturing and control systems. This is a lab course to accompany ENGT 260.

Prerequisites: Motor Control Concepts-470333
Motor Control Concepts lab-470334

Content/Process

Students will:

1. Explain the set-up, repair, and maintenace of automatic machines.
2. Explain the set-up, repair, and maintenance of processing equipment.
3. Explain the set-up, repair, and maintenance of robots that work together as part of a total automated manufacturing system.
4. Develop cost/benefit analysis for automation.
5. Develop case stuides for improving production, efficiency, and profitability.
6. Anaylze, summarize, and interpret major factors in automation to include operator training, teamwork, resistance, and organized labor.
7. Analyze and develop safety strategies for automated systems.
8. Develop on-line and off-line robot programs.
9. Describe components in the integrated manufacturing environment.
10. Demonstrate knowledge of robot terminology.
11. Read and understand technical manuals.
12. Explain how to perform preventative maintenance.
13. Identify and describe the functions of vision systems.
14. Describe open loop and closed loop control.
15. Demonstrate knowledge of servo and non-servo systems.
16. Demonstrate knowledge of robot classifications.
17. Define computer-integrated manufacturing (CIM) systems.
18. Develop a safety strategy for automated work cells. Include: risk assessment and risk reduction.
19. Demonstrate leadership skills.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Robotics and Industrial Automation Lab-B (Ind.Maint)
470353

Course Description:
Introduction to the theory of robots including terminology, components, and basic programming. Provides theory of serve and non-servo robots. Topics include robot types, controllers, manipulators, basic robotic programming, and fluid power systems. Provides basic theory of flexible and computer-integrated manufacturing and control systems. This is a lab course to accompany ENGT 260.

Prerequisites: Motor Control Concepts-470333
Motor Control Concepts lab-470334

Content/Process

Students will:

1. Explain the set-up, repair, and maintenace of automatic machines.
2. Explain the set-up, repair, and maintenance of processing equipment.
3. Explain the set-up, repair, and maintenance of robots that work together as part of a total automated manufacturing system.
4. Develop cost/benefit analysis for automation.
5. Develop case stuides for improving production, efficiency, and profitability.
6. Anaylze, summarize, and interpret major factors in automation to include operator training, teamwork, resistance, and organized labor.
7. Analyze and develop safety strategies for automated systems.
8. Develop on-line and off-line robot programs.
9. Describe components in the integrated manufacturing environment.
10. Demonstrate knowledge of robot terminology.
11. Read and understand technical manuals.
12. Explain how to perform preventative maintenance.
13. Identify and describe the functions of vision systems.
14. Describe open loop and closed loop control.
15. Demonstrate knowledge of servo and non-servo systems.
16. Demonstrate knowledge of robot classifications.
17. Define computer-integrated manufacturing (CIM) systems.
18. Develop a safety strategy for automated work cells. Include: risk assessment and risk reduction.
19. Demonstrate leadership skills.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Shielded Metal Arc Welding (Ind.Maint)
470354

Course Description:
Teaches students the identification, inspection, and maintenance of SMAW electrodes; principles of SMAW; the effects of variables on the SMAW process to weld plate and pipe; and metallurgy.

Pre-requisite: None

Content/Process

Students will:

1. Practice welding safety procedures
2. Identify, select, and store SMAW electrodes
3. Apply principles of SMAW process to cut and weld metals
4. Apply the knowledge of the effects of variables on the SMAW process to weld plate and pipe
5. Apply the knowledge of basic metallurgy to control chemical, physical, and mechanical properties of carbon steel
6. Use shop equipment and tools

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Shielded Metal Arc Welding Fillet Lab (Ind.Maint)
470355

Course Description:
Provides laboratory experiences in which the student acquires the manipulative skills to perform fillet welds in all positions.

Co-requisite: Shielded Metal Arc Welding (Ind.Maint)-470355

Content/Process

Students will:

1. Practice welding safety procedures
2. Identify, select, and store SMAW electrodes
3. Apply principles of SMAW process to cut and weld metals
4. Apply the knowledge of the effects of variables on the SMAW process to weld plate and pipe
5. Apply the knowledge of basic metallurgy to control chemical, physical, and mechanical properties of carbon steel
6. Use shop equipment and tools

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Shop Management
470301

Course Description:
This course introduces the basic principles of sound and efficient shop management. Inventory control, fiscal management, and customer relations are emphasized.
Prerequisite: None

Content/Process

Students will:

1. Explain safety.
2. Maintain tools/equipment
3. Develop customer relations skills
4. Prepare work orders
5. Maintain inventory
6. Maintain service records
7. Supervise personnel
8. Prepare parts requisition
9. Provide fiscal management
10. Complete an incident report

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Welding for Maintenance
470328

Course Description:
This course will provide basic instruction needed for student to weld using SMAW, MIG, TIG and Oxy-Fuel.

Prerequisite: None

Content/Process

Students will:

1. Explain welding safety.
2. Describe the selection,care, and storage of Oxy-Fuel cutting equipment.
3. Explain the identification, selection, and storage of SMAW electrodes.
4. Apply principles of SMAW process to cutting welding metals.
5. Describe the set up and use of SMAW welders.
6. Explain the application of basic metallurgy principles to control chemical, physical, and mechanical properties of carbon steel.
7. Explain the proper use of shop equipment and tools.
8. Explain the set up and use of MIG welders.
9. Explain the set up and use of TIG welders.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA

Welding for Maintenance Lab
470329

Course Description:
Students will apply basic welding skills used in SMAW, MIG, TIG and Oxy-Fuel.

Co-requisite: Welding for Maintenance-470328

Content/Process

Students will:

1. Demonstrate welding safety
2. Set up and cut with oxy-fuel cutting equipment.
3. Identify, select, and store SMAW electrodes.
4. Apply principles of SMAW process to cutting welding metals.
5. Set up and use SMAW welders.
6. Apply basic metallurgy principles to control chemical, physical, and mechanical properties of carbon steel.
7. Use shop equipment and tools.
8. Set up and use MIG welders.
9. Set up and use TIG welders.

Connections

- Common Core State Standards
- Common Core Technical Standards
- KOSSA
- New Generation Science Standards
- National Center for Construction and Education Research
- Post-Secondary Education
- CTSO's - SkillsUSA